Beetles and Bees

Honeybee

Japanese Beetle

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Talk Outline

- Bee diversity
- Honey bee biology
  - Who they are, how they live, why we care
  - Recent problems with bee health
- How to minimize pesticides impact on honey bees
- Japanese Beetle in Utah
  - Biology, pest potential, eradication project in Orem
  - Insect Programs in Utah

What is a bee?

Syrphidae

Bombus

Sphyngidae

Syrphidae

Apis

Syrphidae

Syrphidae

Vespidae

Megachilidae

Cerambycidae

Six legs

four wings

usually hairy

Yellow/black

females sting

Bumble bees

Large ‘furry’ queens emerge in spring

Wax ‘pots’ in loose soil

100s of individuals, all die off

Excellent pollinators

Can sting, not aggressive

Solitary Bees

Live alone, may aggregate
Build with leaves/mud/pulp
Collect pollen, lay egg,
Pupa overwinters
Most stings can’t penetrate
Many native species

Wasps

Paper nest, some mud nests
Only queen survives winter
1000 per nest
Eat other insects or spiders
Generalists, scavenge, pesky at picnics

Honeybees

- Not native to North or South America
- Build wax combs in a hollow tree
- Discovery of ‘bee space’ allowed construction of modern, re-usable equipment
- 60,000 per colony; all overwinter

What’s special about honey bees?

- Social behavior
  - bees live together, share resources, survive winter in group (and eat honey!)
  - One queen per colony (mother to all), many workers, some drones
- Important management for pollination
  - Bees can be kept in boxes and moved
  - One in three bites of food requires pollination
  - Reduced habitat for natural bee populations, intensive growing areas

Value of pollination: $15 billion/yr

- Totally dependent:

  almonds, apples, avocados, blueberries, cranberries, cherries, kiwi fruit, macadamia nuts, asparagus, broccoli, carrots, cauliflower, celery, cucumbers, onions, legume seeds, pumpkins, squash, and sunflowers

- Rely heavily:

  apricot, citrus peaches, pears, nectarines, plums, grapes, brambleberries, strawberries, olives, melon, peanuts, cotton, soybeans, and sugarbeets

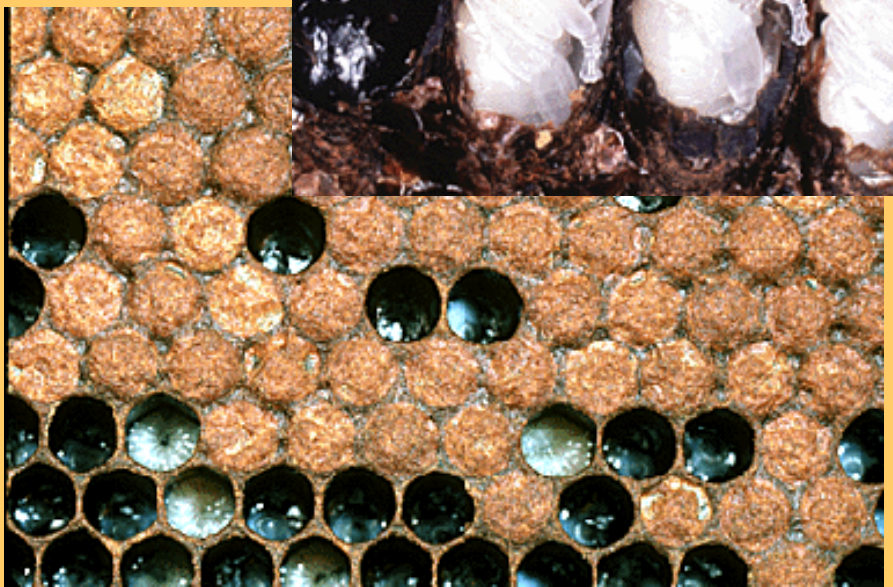
Over 2 million bee colonies are rented each year for pollination services, most of them travel over the road. Rent is up to $150/colony!

Global market

- Can ship bees in the mail
- Stock has been moved extensively
- Imported problems: Africanized bees, Varroa mites, small hive beetle, bacterial, fungal and viral diseases

Who’s home:
Workers, Queens, Drones

Honey bee development

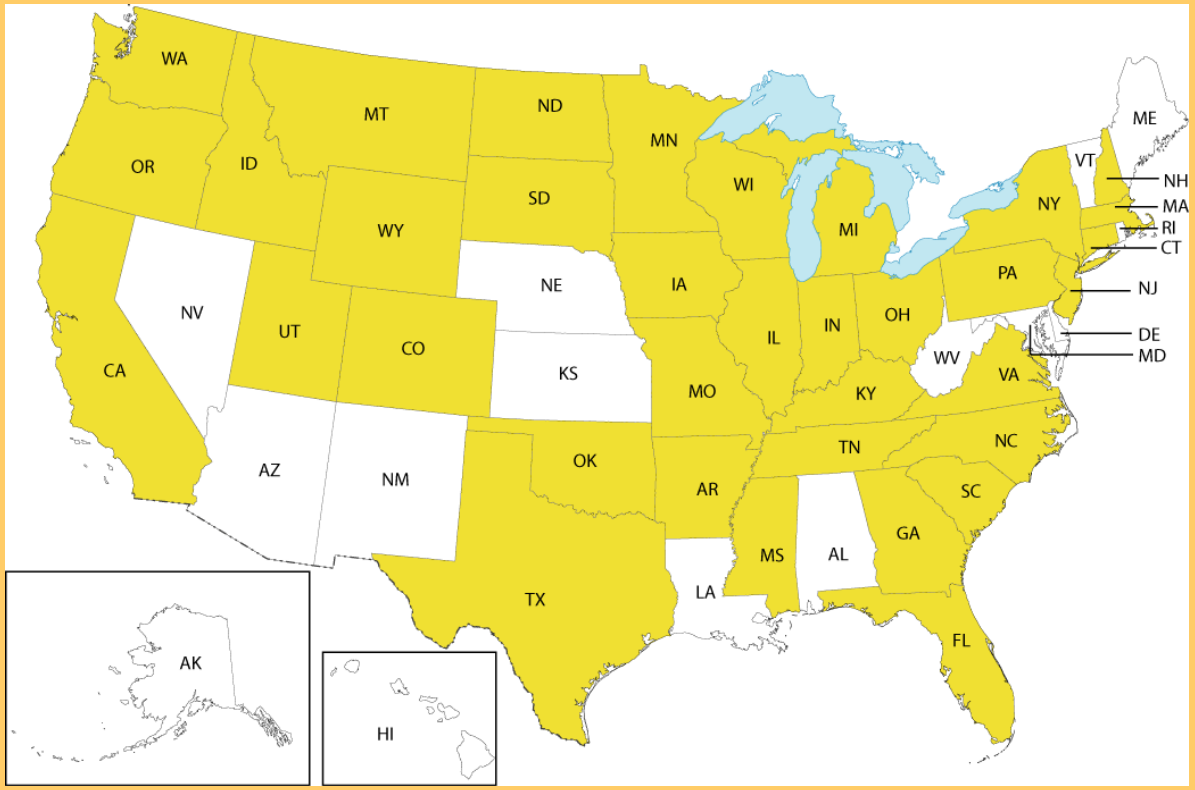


A bee's life

- Adult bees do in-house tasks first
  - Tend queen, feed larvae, clean, handle food, build comb, thermoregulate
- Older bees do riskier tasks
  - Guard entrance, defend nest, drag out dead, forage
- This maximizes work per bee.
  - Summer bees live 3-4 weeks
  - Winter bees live 3-4 months

Colony Collapse Disorder

- Nov 2006, beekeepers saw alarming colony losses in 35 states
- 30-90% losses by migratory beekeepers



Affected States, June 2007

Mysterious Symptoms

- Bees don’t return to hive
- Colony declines quickly
- Delayed robbing, slow invasion

- Looks different than other pathology because there is brood, food, and queen but bees are gone and no one is invading. Colonies have been seen to collapse in only 2 weeks.

Potential causes

- Parasites, mites, disease loads
- New pathogens or new strains of pathogens (eg Israeli Acute Paralysis Virus**)**
- Poor nutrition
- Low genetic diversity
- Stress (eg moving bees for pollination)
- Chemical residues (eg imidacloprid)
- Any combination of these…
  - Cell phones, global climate change, feed supplements, GMO crops NOT leading suspects.

Israeli Acute Paralysis Virus

- Originally discovered in Israel
- Found in Australian bees (no CCD, also no Varroa mite)
- Recent study shows strong correlation between IAPV presence and CCD, but no causal link yet
  - Sampled diseased colonies, found IAPV
  - Irradiated combs, stopped disease

Implications of CCD

- Hardship for beekeepers, increased management costs, loss of livelihood
- Research in the next year will be informative, jury still out
- Bees are resilient and beekeepers are resourceful, but it is a delicate balance.
- Fewer bees
  - Less pollination, higher produce costs

Pesticides and bees

- If it kills insects it will probably kill bees
- If it kills plants, it might kill bees
- If it gets into water, it might kill bees

Blossoms ➔ Bees!

Communication and Cooperation

- Look for apiaries, inquire within 3 mile radius
- Watch for honeybees on blossoms
- Notify beekeepers the night before.
- Consider alternatives (IPM and bee toxicity)

Reducing pesticide impact on bees

Growers/applicators

- Avoid using dusts
- Use less bee-toxic chemicals
- Apply late evening, night or early morning when there are few foraging bees
- Avoid drift
- Ground application safer than aerial.
- Don’t spray blossoms. (ditch weeds too!!!)

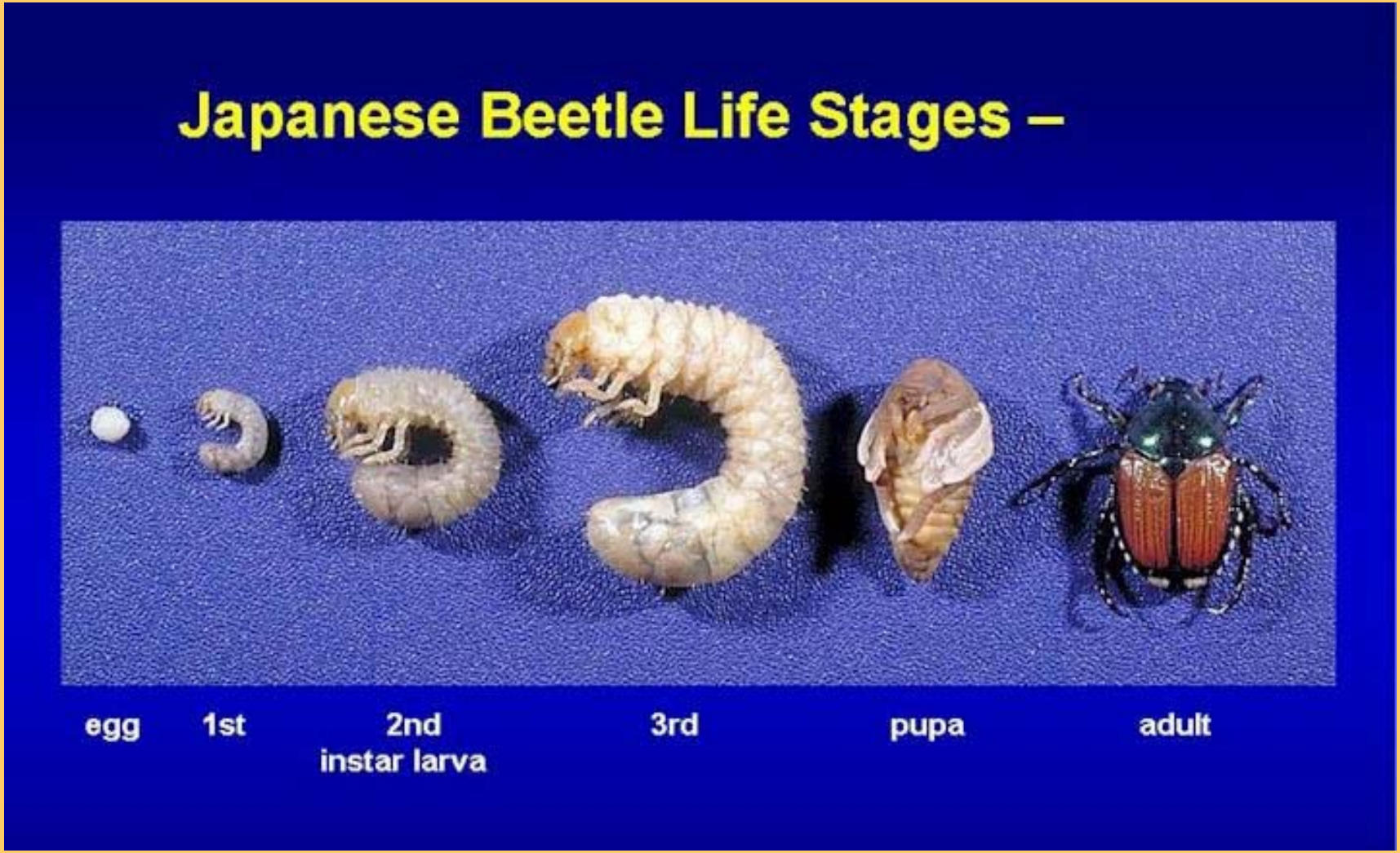
Beekeepers

- Choose apiaries with low pesticide risk
- Notify growers, county agent, bee inspector of your location
- Move bees if the risk is high (long residual, frequent sprays, etc)
- Confine bees for short durations if necessary

Japanese Beetle

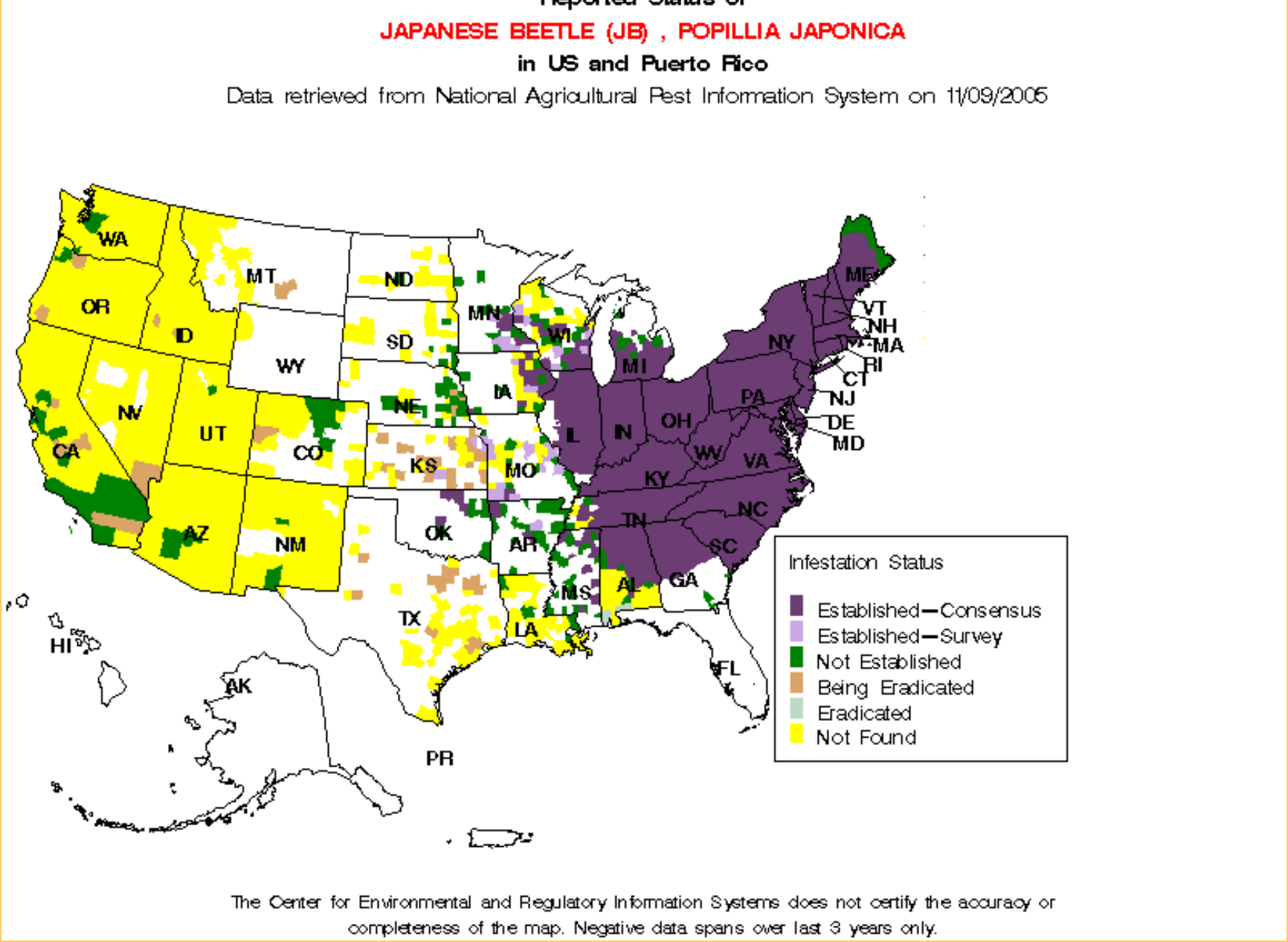
Japanese Beetle Life Stages

Adult beetle ~ 3/8 “ long



Know Your Target

- Furry Bear beetle is a native beetle and an important pollinator
- Many homeowners call about this beetle



- Currently under eradication in California, Colorado, Montana, Oregon, Washington, and Utah.

Larval Damage

M.G. Klein, USDA Agricultural Research Service, www.insectimages.org

Adult Damage

M.G. Klein, USDA Agricultural Research Service, www.insectimages.org

Adult damage

- aggregation pheromone attracts more beetles to food.
- feed on the upper surface of the leaf between veins, creating a lacey or skeletonized appearance.

Adults voracious feeders on over 300 plant species

Grubs destroy turf. Adults eat leaves, flowers, fruit.

Preferred Plant Hosts

- Apple, Crab Apple
- Apricot
- Cherry
- Peach
- Pear
- Plum
- Blackberry/Raspberry
- Blueberry
- Grape
- Corn
- Turf
- Roses (*Rosa* species)
- Virginia Creeper
- Rose of Sharon
- Japanese Maple
- Norway Maple
- American Elm
- Lombardy Poplar
- American Linden
- Mountain Ash

JB History in Utah

- 500 Detection Traps statewide for 8 years
- 1 JB Found at SL International Airport in 2005. Hitch-hiker
- JB Found in Orem July 2006
- 100 Delimiting Traps Set to Determine Extent of Infestation
- 672 JB's Caught
- 2007 Treatment Planned

Japanese beetle Trap

Floral lure attracts both males and females

Pheromone attracts only the males

Lures are replaced monthly

Yellow trap top is very attractive to the beetles

Trap is most effective when placed in sunny locations

2007 Planning: Control or Eradication?

- Biological Control
  - Effective for Control
  - Takes More Time
  - Labor Intensive
  - Expensive
  - Population will Persist
- Chemical Control
  - Effective for Eradication
  - Fast Acting
  - Cost Effective

Utah County residents would pay ~$34 million annually to control Japanese beetle once it was established.

Utah has $124 million nursery and floriculture economy

Orem Japanese Beetle Program

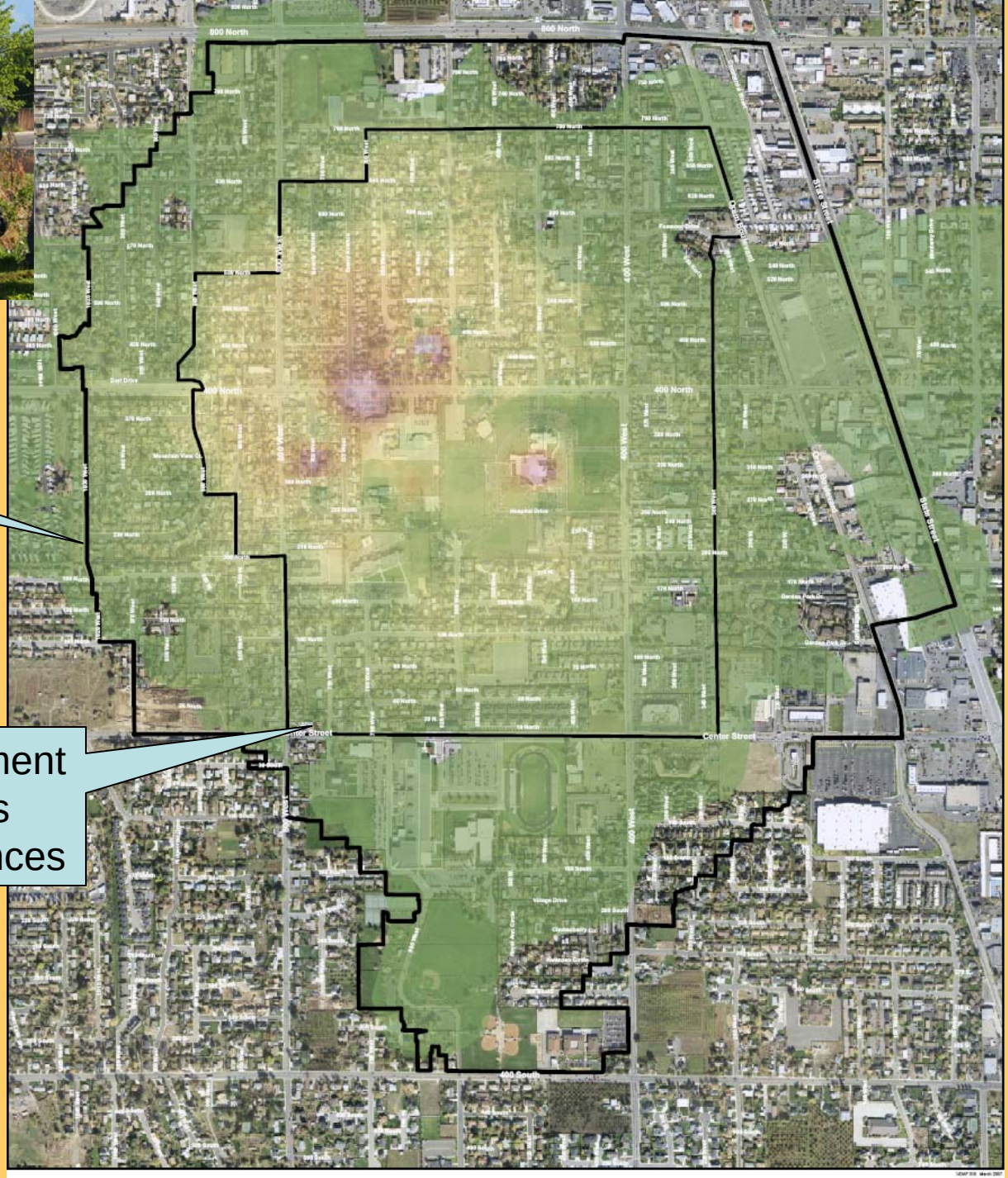
- Treatment Approach
  1) Containment
     - Alter Orem City Green Waste Program
     - Recommend Quarantine
  2) Turf Treatment (2300 parcels)
  3) Foliar Treatment Area (1500 parcels)
  4) Increase Trap Densities in Treatment Area

Orem Japanese Beetle Program

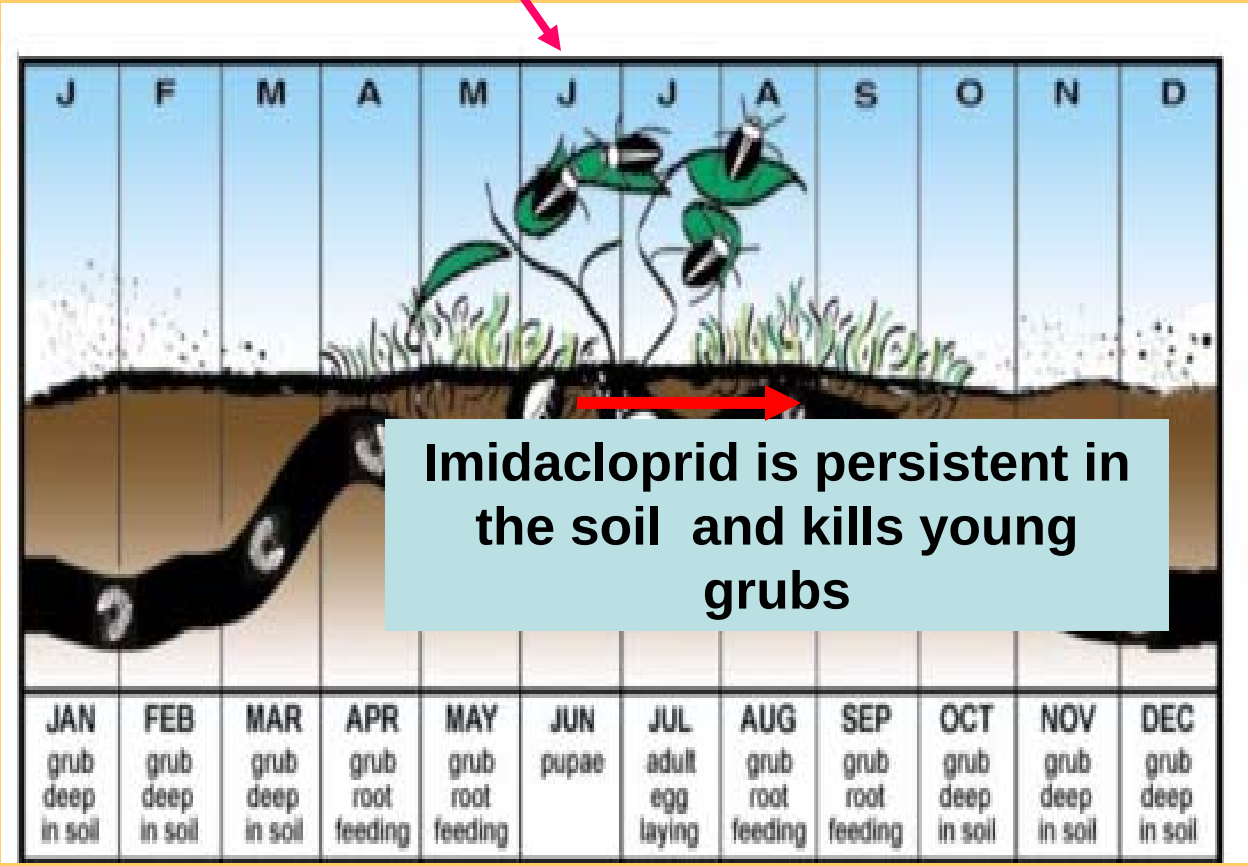
- Funding
  - Emergency Insect Fund (Non-lapsing)
- Outreach
  - Public Affairs Officer
  - Orem City Neighborhoods in Action
- Treatment
  - Office of the Attorney General
  - Utah Code Title 04 Chapter 35
    - Insect Infestation Emergency Control Act
- Technology
  - Pheromones, Traps, Flora Lure
  - Pesticides
  - GIS Parcel Data

Turf Treatment
480 Acres
2200 residences

Foliar Treatment
250 Acres
1200 residences

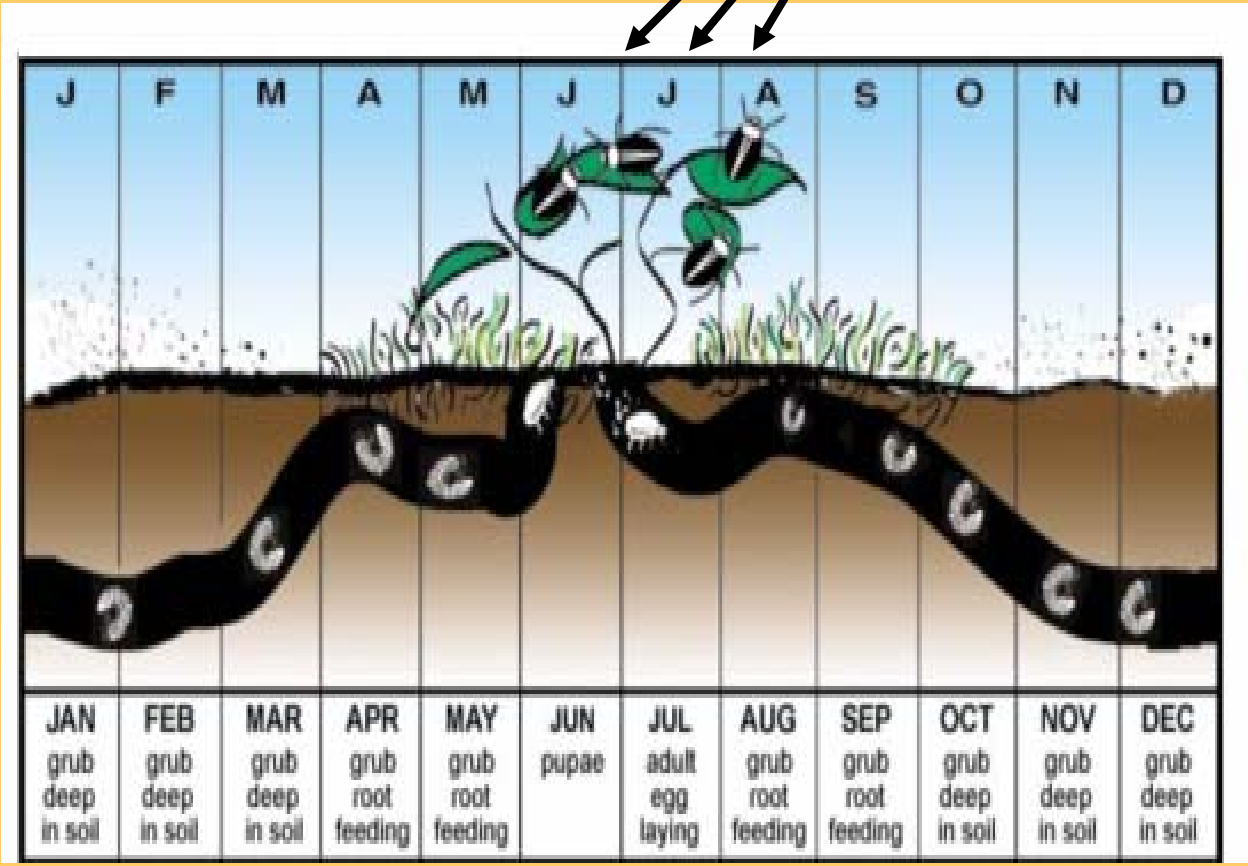


Imidacloprid Turf Application



Tempo and Carbaryl Applications

Two foliar applications were applied, a third application to “hot spots”

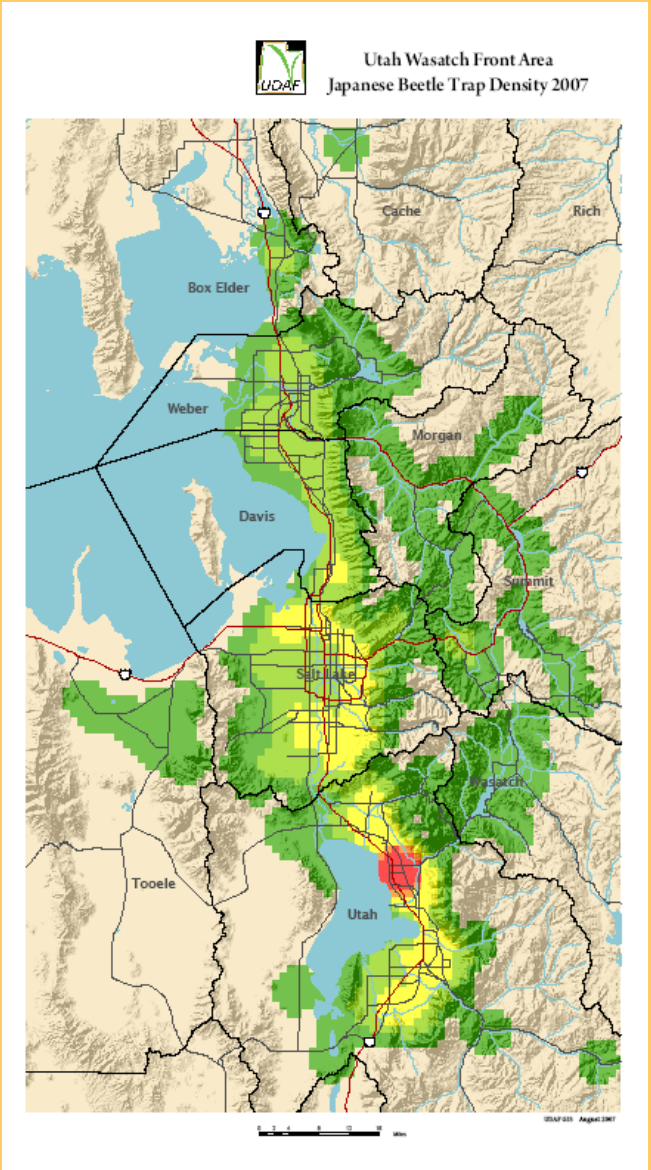


Utah Japanese Beetle Program
Treatment dates

- Acres Treated
  - Turf ~ 480 acres
  - Foliar ~ 250 acres
- Treatment Dates
  - Turf Treatment - *Merit*
    - June 1-18th, and June 21st
  - Foliar Treatment – *Tempo/Carbaryl*
    - July 5-18th, and July 25th
  - Additional Turf Treatment with *Arena*
    - Aug. 10th ~ 5 acres

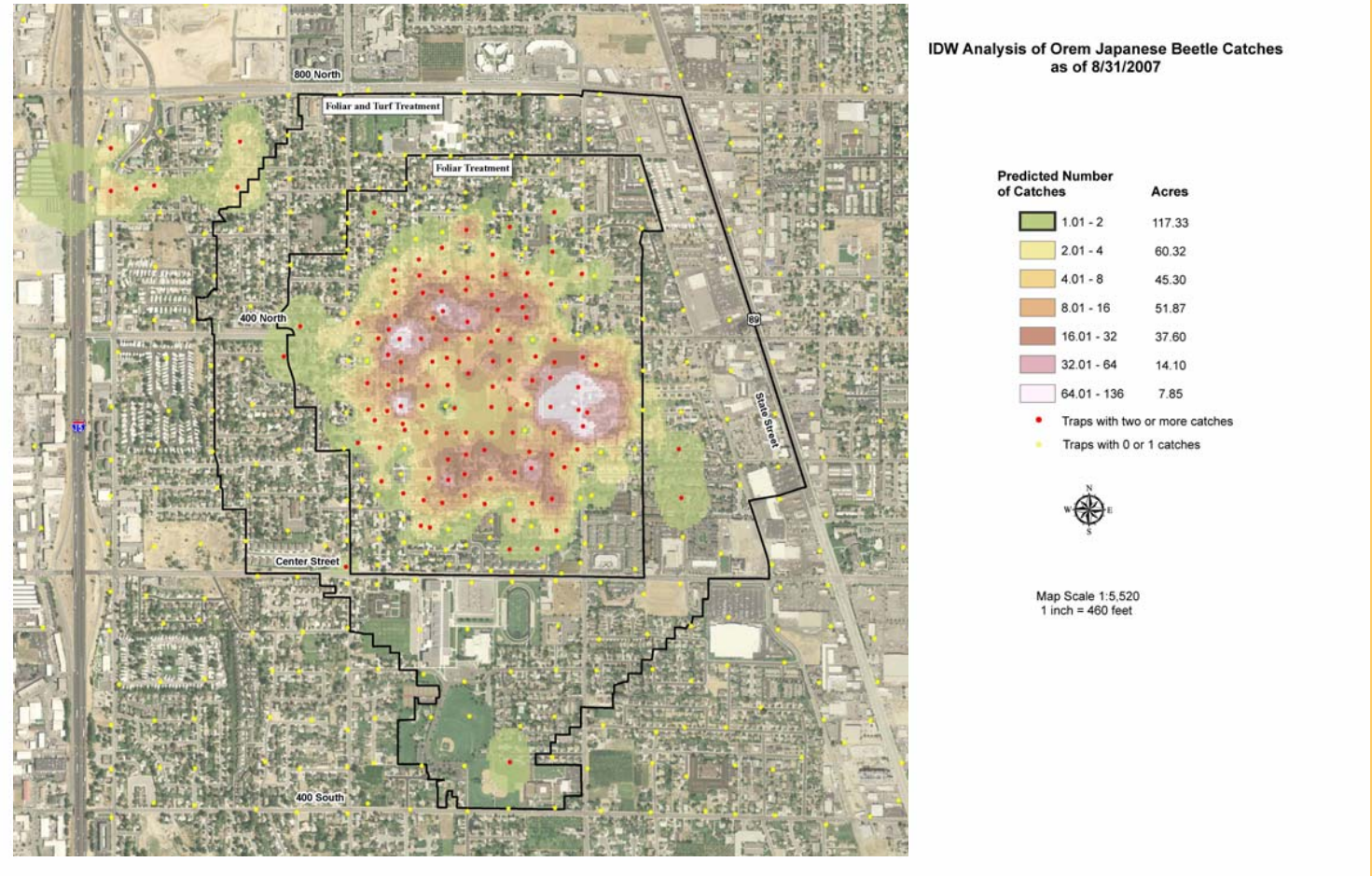
Utah Japanese Beetle Program Trapping

2006 Total Catches – 675
2007 Total Catches – 2153
First Positive Catch 2007
6/14/07
Last positive catch 2007
9/27/07
Orem Grid Checked 2x/week
Utah County Traps monthly



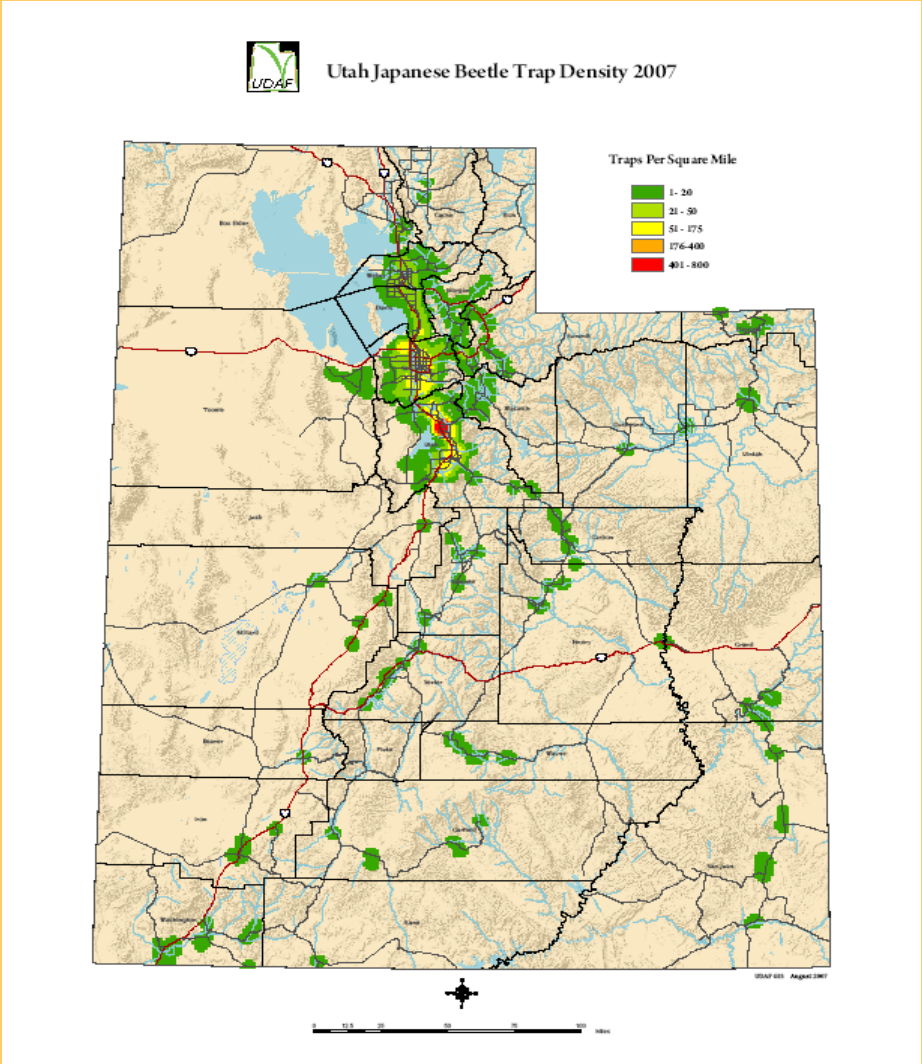
Utah Japanese Beetle Program Trapping

Results of 2007 Orem City Trapping Efforts



Utah Japanese Beetle Program Trapping

- Traps Statewide
  - 2006 – 581 Traps
  - 2007 – 3000 Traps
- Traps in Utah County
  - 2006 – 199 Traps
  - 2007 – 1418 Traps



UDAF Insect Survey Programs

- Africanized Honey Bee
- Apple Maggot
- Asian Gypsy Moth
- Asian Long Horn Beetle
- Cereal Leaf Beetle
- Cherry Fruit Fly
- Egyptian Cotton Worm
- Emerald Ash Borer
- False Codling Moth
- Gypsy Moth
- Japanese Beetle
- Mormon Cricket & Grasshopper
- Nun Moth
- Red Imported Fire Ant
- Rosy Gypsy Moth
- Siberian Moth
- Silver Y Moth
- Sirex Noctillio (European Woodwasp)

Invasive Pest Detection and Eradication

- Quarantines
- Inspections
- Detection Networks
- Target High Risk Areas
- Taxonomic Support
- Effective Traps and Lures
- Partnership

Critical Partnerships

- Dept Homeland Security USCIS
- DWR State Lands and Forestry
- National Plant Board
- National Plant Diagnostics Network
- State Departments of Agriculture
- USDA APHIS Plant Pest Qx
- USDA FS Forest Health Protection
- USU Plant Pest Diagnostics Lab

Acknowledgements

- Clint Burfitt, Ryan O’Shea, Kelly Oneida-UDAF
- APHIS
- Utah State University Extension Service

Utah Japanese Beetle Program

Bacillus popilliae – Milky Disease

- ***Bacillus popilliae* germinate poorly, it would require 1,000,000 – 100,000,000 spores to cause 50-80% infection** (**Stackebrandt, E., and B. M. Goebel.** 1994. Taxonomic Note: A Place for DNA-DNA Reassociation and 16S rRNA Sequence Analysis in the Present Species Definition in Bacteriology. Int. J. Syst. Bacteriol. **44**(4)**:**846-849).

- **Establishment of Milky Disease is dependent on larvae densities between 180 – 480 per square meter. Orem larvae densities are < 1 per square meter** (**Beard, R. L.** 1945. Studies on the milky disease of Japanese beetle larvae. Conn. Agr. Exp. Sta. Bull. **491:**505-583).

- **USDA APHIS - Milky disease is a control option not an agent capable of eradication** (Anwar S. Rizvi National Japanese Beetle Program Manager 3/21/07).

Utah Japanese Beetle Program

Heterorhabditis bactriophora

Steinernema glaseri

- **Steinernema glaseri – not available commercially (research only)**
- **Heterorhabditis bactriophora**
  - **Average parasitization is ~80% when soil temperatures are from 70° to 86°F, but is less than 40% when temperatures are less than 60°F** (*Yeh, T. and S. R. Alm. 1995. Evaluation of* Steinernema glaseri *(Nematoda: Steinernematidae) for biological control of Japansese and Oriental beetles (Coleoptera: Scarabaeidae). J. Econ. Entomol. 88(5): 1251-1255.)*.